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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/590,685

08/25/2006

Timothy C. Frank

61377A

1216

109 7590 04/08/2009

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Intellectual Property Section
P.O. Box 1967
Midland, MI 48641-1967

EXAMINER

ZALASKY, KATHERINE M

ART UNIT

PAPER NUMBER

1797

MAIL DATE

DELIVERY MODE

04/08/2009

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/590,685	Applicant(s) FRANK ET AL.	
	Examiner KATHERINE ZALASKY	Art Unit 1797	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-15 is/are pending in the application.
- 4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-15 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on ____ is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. ____. |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>20060825, 20080724</u> . | 6) <input type="checkbox"/> Other: ____. |

DETAILED ACTION

Specification

1. The abstract of the disclosure is objected to because it is not limited to a single paragraph. Correction is required. See MPEP § 608.01(b).

Claim Rejections - 35 USC § 103

2. **Claims 1, 3, 4, 6, 7, 10 and 12-14** are rejected under 35 U.S.C. 103(a) as being unpatentable over Baniel et al. (US 3,556,739).

Regarding **claims 1, 8, and 9**, Baniel et al. discloses a method of separating a hydrophilic compound from an aqueous liquor (abstract) comprising the steps of:

- (a) intermixing a sufficient quantity of a glycol ether with the aqueous liquor at a first temperature to form a suspension comprising an aqueous raffinate phase and a glycol ether extract phase comprising said glycol ether, water in saturated quantity, and a portion of the hydrophilic compound (C2/L12-22, C2/L63-C3/L3, Example 3, C7/L1-11), the glycol ether having the formula: **$R'-(OCHR''CHR''')_n-O-R'''$**

wherein R' is an alkyl group of 1 to 8 carbon atoms, R'' is, independently in each occurrence, hydrogen, methyl or ethyl, R''' is hydrogen, an alkyl group having from 1 to 4 carbon atoms, a propionyl or an acetyl group, n is an integer between 1 and 4, with the proviso that R''' is methyl when R' and R'' are each methyl group, and wherein the glycol ether has an inverse solubility in water and the partition ratio,

value K, for the hydrophilic organic compound is greater than 0.1
(C2/L37-46, n-hexyl carbitol = diethylene glycol n-hexyl ether)

- (b) separating the glycol ether extract phase formed in step (a) from the aqueous raffinate phase (C2/L63-C3/L3, Example 3, C7/L1-11)
- (c) heating the glycol ether extract phase obtained in step (b) to a second temperature which is higher than the first temperature to form a suspension comprising an aqueous extract phase containing a portion of the hydrophilic organic compound and a glycol ether raffinate phase (C2/L63-C3/L3, Example 3, C7/L1-11)
- (d) separating the glycol ether raffinate phase formed in step (c) from the aqueous extract phase (C2/L63-C3/L3, Example 3, C7/L1-11)

While Baniel et al. does disclose that the process may be used to extract a hydrophilic compound from an aqueous solution (abstract), the reference does not disclose that the process may be used to extract a hydrophilic organic compound. Particularly, the reference does not disclose that the process may be used to extract a hydrophilic organic compound which is selected from the group consisting of:

- carboxylic acids, sulfonic acids, polyhydroxy compounds, amino acids and amides
- formic acid, acetic acid, propionic acid, butyric acid, lactic acid, citric acid, benzoic acid, ascorbic acid, adipic acid, succinic acid, methacrylic acid, lauric acid, stearic acid, glycolic acid, glycerin, glucose, caprolactam, 1,3-

propanediol, 1,2-propanediol, 2,3- butanediol, xylitol, p-toluene sulfonic acid, methane sulfonic acid, and dodecylbenzene sulfonic acid

However, it is known in the art to use glycol ether solvents for the extraction of organic acids (as evidenced by Kimble, US 4,322,550, abstract, carboxylic acids). It is also known in the art that organic acids, such as lactic acid, citric acid and succinic acid, may be extracted with oxygenated solvents which contain at least one ether group (Lehnhardt et al., US 5,426,219, C3/L67-C4/L5, C6/L30-39). Therefore, it would have been obvious to one having ordinary skill in the art to apply the known extraction technique of Baniel et al. to an organic acid as opposed to phosphoric acid since glycol ether solvents are known to be used in organic acid extractions and one of ordinary skill in the art would have a reasonable expectation of success in doing so.

Regarding **claim 3**, Baniel et al. discloses all of the claim limitations as set forth above. Additionally, while the reference does not explicitly disclose the method wherein the intermixing of the glycol ether with the aqueous liquor in step (a) is conducted at a temperature that is no more than 30 centigrade degrees above the lower critical solution temperature (LCST), the reference does disclose that the temperature during the mixing is 25°C (Example 3, C7/L1-11). As the LCST of diethylene glycol n-hexyl ether is 12°C (as evidenced by Allen et al., "Use of glycol ethers for selective release of periplasmic proteins from gram-negative bacteria", Table 2), this temperature is below 42°C.

Regarding **claim 4**, Baniel et al. discloses all of the claim limitations as set forth above. Additionally, the reference discloses the method wherein step (d) includes the following steps:

- (e) intermixing a sufficient quantity of water with the mixture formed in step (c) to form a mixture of a glycol ether raffinate phase further depleted in the hydrophilic organic compound and an aqueous extract phase containing the added water and additional hydrophilic organic compound (C4/L62-71,C5/L24-28)
- (f) separating the aqueous extract phase formed in step (e) from the glycol ether raffinate phase (C4/L62-71,C5/L24-28)

Regarding **claims 6 and 7**, modified Baniel discloses all of the claim limitations as set forth above. Baniel et al. does not explicitly disclose the method wherein the aqueous raffinate phase separated in step (b) or the aqueous extract phase separated in step (d) are further contacted with a hydrophobic organic solvent or blends thereof to recover residual glycol ether. Further, Baniel et al. does not disclose the method wherein the aqueous extract phase separated in step (f) is further contacted with a hydrophobic organic solvent or blends thereof to recover residual glycol ether.

However, solvent regeneration methods are well known in the art and are commonly employed to recover solvent from aqueous solutions (as evidenced by Lehnhardt et al, US 5,426,219, C8/L11-30). It would have been obvious to one having ordinary skill in the art to use a hydrophobic organic solvent in this recovery process as it will help reduce the miscibility of the solvent with water (as evidenced by Shinnar et al. US 5,628,906, C3/L8-29) and provide a rapid separation of the phases.

Regarding **claim 10**, Baniel et al. discloses all of the claim limitations as set forth above. While the reference does not explicitly disclose that the partition ratio, K value,

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is greater in step (a) than in step (c), the reference does disclose that the heating separates the mixture into an organic solvent phase and an aqueous phase with the purified organic acid (C2/L63-C3/L3, Example 3, C7/L1-11). Therefore, the partition ratio ($K = [A]_{\text{org}}/[A]_{\text{aq}}$) in step (a) would inherently be larger than that of step (c).

Regarding **claim 12**, Baniel et al. discloses all of the claim limitations as set forth above. Additionally, the reference discloses the method wherein the glycol ether is selected from the group consisting of dipropylene glycol ethyl ether, tripropylene glycol ethyl ether, propylene glycol isopropyl ether, dipropylene glycol isopropyl ether, tripropylene glycol isopropyl ether, propylene glycol n-propyl ether, dipropylene glycol n-propyl ether, tripropylene glycol n-propyl ether, propylene glycol t-butyl ether, dipropylene glycol t-butyl ether, tripropylene glycol t-butyl ether, propylene glycol n butyl ether, dipropylene glycol n-butyl ether, tripropylene glycol n-butyl ether, propylene glycol n- pentyl ether, propylene glycol n-hexyl ether, butylene glycol methyl ether, dibutylene glycol methyl ether, ethylene glycol n-butyl ether, ethylene glycol n-pentyl ether, ethylene glycol n-hexyl ether, ethylene glycol n-heptyl ether, ethylene glycol 2-ethylhexyl ether, diethylene glycol n-hexyl ether, propylene glycol methyl ether acetate, propylene glycol ethyl ether acetate, propylene glycol isopropyl ether acetate, propylene glycol n-propyl ether acetate, propylene glycol n-butyl ether acetate, dipropylene glycol methyl ether acetate, dipropylene glycol ethyl ether acetate, ethylene glycol n-butyl ether acetate, propylene glycol isobutyl ether, dipropylene glycol isobutyl ether, tripropylene glycol isobutyl ether, ethylene glycol t-butyl ether, ethylene glycol isobutyl ether, ethylene glycol ethyl ether acetate, ethylene glycol isobutyl ether acetate,

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diethylene glycol ethyl ether acetate, dipropylene glycol dimethyl ether, and diethylene glycol n-butyl ether acetate and blends thereof (C2/L37-46, n-hexyl carbitol = diethylene glycol n-hexyl ether)

Regarding **claim 13**, Baniel et al. discloses all of the claim limitations as set forth above. Additionally, the reference discloses a method of separating a hydrophilic compound from an aqueous liquor (abstract) comprising the steps of:

- (a) intermixing a sufficient quantity of a glycol ether with the aqueous liquor at a temperature not more than 30 centigrade degrees above the lower critical solution temperature (LCST) (temperature during the mixing is 25°C, Example 3, C7/L1-11, the LCST of diethylene glycol n-hexyl ether is 12°C, this temperature is below 42°C), to form a suspension comprising an aqueous raffinate phase and a glycol ether extract phase comprising said glycol ether, water in saturated quantity, and a portion of the hydrophilic compound (C2/L63-C3/L3, Example 3, C7/L1-11), the glycol ether having the formula:



wherein R' is an alkyl group of 1 to 8 carbon atoms, R'' is, independently in each occurrence, hydrogen, methyl or ethyl, R''' is hydrogen, alkyl group having from 1 to 4 carbon atoms, a propionyl or an acetyl group, n is an integer between 1 and 4, with the proviso that R''' is methyl when R' and R'' are each methyl (C2/L37-46, n-hexyl carbitol = diethylene glycol n-hexyl ether)

- (b) separating the glycol ether extract phase formed in step (a) from the aqueous raffinate phase (C2/L63-C3/L3, Example 3, C7/L1-11)

Baniel et al. does not disclose that the process may be used to extract a hydrophilic organic compound. Particularly, the reference does not disclose that the process may be used to extract a hydrophilic organic compound which is selected from the group consisting of citric acid, lactic acid, formic acid, acetic acid, succinic acid, ascorbic acid, 1,3-propanediol, 1,2-propanediol, glycerin, and p-toluene sulfonic acid.

However, it is known in the art to use glycol ether solvents for the extraction of organic acids (as evidenced by Kimble, US 4,322,550, abstract, carboxylic acids). It is also known in the art that organic acids, such as lactic acid, citric acid and succinic acid, may be extracted with oxygenated solvents which contain at least one ether group (Lehnhardt et al., US 5,426,219, C3/L67-C4/L5, C6/L30-39). Therefore, it would have been obvious to one having ordinary skill in the art to apply the known extraction technique of Baniel et al. to an organic acid as opposed to phosphoric acid since glycol ether solvents are known to be used in organic acid extractions and one of ordinary skill in the art would have a reasonable expectation of success in doing so.

Regarding **claim 14**, modified Baniel discloses all of the claim limitations as set forth above. Additionally, Baniel et al. discloses the method wherein said temperature is not more than 20 centigrade degrees above the LCST (25°C, Example 3, C7/L1-11, the LCST of diethylene glycol n-hexyl ether is 12°C, this temperature is below 32°C).

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3. **Claims 2 and 11** are rejected under 35 U.S.C. 103(a) as being unpatentable over Baniel et al. (US 3,556,739), as applied to **claim 1** above, and further in view of Shinnar et al. (US 5,628,906).

Regarding **claims 2 and 11**, modified Baniel discloses all of the claim limitations as set forth above. While the reference does disclose that a small amount of water may be introduced during step (c) to help facilitate a phase separation (C2/L63-C3/L3), the reference does not disclose the method wherein the step (c) is conducted in the presence of a hydrophobic organic solvent selected from the group consisting of:

- an alcohol having from 4 to 14 carbon atoms, a ketone having from 4 to 14 carbon atoms, a chlorinated hydrocarbon having from 2 to 6 carbon atoms, an aromatic compound having from 6 to 12 carbon atoms, and an ether having from 6 to 19 carbon atoms, and blends thereof
- 1-octanol, 2-ethylhexanol, 2-pentanone, 2-nonanone, diisobutylketone, methylisobutylketone, methylene chloride, toluene, dichlorobenzene, and di-n-butyl ether and blends thereof

Shinnar et al. teaches a solvent extraction method in which a primary solvent is first mixed with a solute which is dissolved in a native solvent, e.g. water, and then a second solvent or modifier is added to the mixture (C3/L8-29). The second solvent or modifier is generally much more soluble with the primary solvent and serves to reduce the miscibility of the primary solvent with the native solvent, e.g. water (C3/L8-29). Overall, the addition of the modifier speeds up the phase separation.

Baniel et al. and Shinnar et al. are analogous because both references are directed to extraction methods

It would have been obvious to one having ordinary skill in the art at the time of the invention to add a second solvent or modifier during step (c) in the method of modified Baniel, as taught by Shinnar et al., since doing so will reduce the miscibility of the n-hexyl carbitol with water, thus increasing the speed of the phase separation

While modified Baniel does not specify the composition of the second solvent or modifier, it would have been obvious to one having ordinary skill in the art to choose a second solvent or modifier which is highly soluble with glycol ether compounds. Accordingly, one of ordinary skill in the art would have optimized, by routine experimentation, the choice of a second solvent in order to achieve a rapid phase separation (In re Boesch, 617 F.2d. 272, 205 USPQ 215 (CCPA 1980)).

4. **Claims 5 and 15** are rejected under 35 U.S.C. 103(a) as being unpatentable over Baniel et al. (US 3,556,739), as applied to **claims 1 and 13** above, and further in view of Ludmer et al. (US 4,954,260).

Regarding **claims 5 and 15**, Baniel et al. discloses all of the claim limitations as set forth above. The reference does not disclose the method wherein the steps of intermixing and separating phases are conducted in counter-current multistage extraction equipment. Baniel et al. does disclose, however, that multistage countercurrent extraction techniques may be used in a similar procedure where the temperature is not raised (C5/L50-58).

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Further, Ludmer et al. discloses a multistage countercurrent separation apparatus which is useful in extractions which utilize the LCST to form a single homogeneous phase and a heterogeneous phase (abstract, C1/L61-C2/L5). This type of apparatus is advantageous for these extractions as it provides better mass transfer and therefore, a higher stage of efficiency may be achieved (C4/L63-68).

Baniel et al. and Ludmer et al. are analogous because both references are directed to temperature driven extraction techniques.

It would have been obvious to one having ordinary skill in the art at the time of the invention to use multistage countercurrent extraction equipment in the method of modified Baniel, as taught by Ludmer et al., since doing so will increase mass transfer during the extraction and increase the efficiency of the extraction.

Conclusion

5. Any inquiry concerning this communication or earlier communications from the examiner should be directed to KATHERINE ZALASKY whose telephone number is (571) 270-7064. The examiner can normally be reached on Monday-Thursday, 7:30am - 6:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vickie Kim can be reached on (571)272-0579. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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/KZ/

4 April 2009

/Krishnan S Menon/

Primary Examiner, Art Unit 1797